Quarterly Report—Public Page

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Contract Number:	DTPH56-05-T-0001
Prepared for:	United States Department of Transportation Pipeline and Hazardous Materials Safety Administration Office of Pipeline Safety
Project Title:	"Understanding Magnetic Flux Leakage (MFL) Signals from Mechanical Damage in Pipelines"
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Public Page Section- This section contains information on the technical status of the Project and the milestones completed during the quarter. Information will be information that PHMSA may release to the public in whole or in part at any time. The information must not contain proprietary data or confidential business information. The Team Project Manager must provide a point of contact for coordination, preparation, and distribution of any press releases.

Technical Results and Conclusions

Task 17: Magnet Pole Piece Liftoff Modeling

The detector moves from left to right. The cumulative study of magnet pole piece and detector liftoff revealed the following interesting features of MFL patterns:

- The detector liftoff decreases the strength of the signal on the side of the liftoff. Radial signal is more affected by the detector liftoff.
- The magnet pole piece liftoff (discontinuity fraction) weakens the overall signal, but the signal on the side of the liftoff is somewhat stronger than on the other side. So, in some cases, it may annul the effect of detector liftoff.
- For the cases of large magnet liftoff, the pattern on the liftoff side changes significantly, as shown in Figure 2 and may deviate considerably from its normal shape.
- Both axial and radial signals are affected by the magnet liftoff. The relative change in signal strength may vary depending on the liftoff and defect geometry.

Task 18: Experimental Verification Measurements

For experimental verification of modeled results, the team used samples from the previous and concurrent projects. The magnet liftoff was introduced by using steel spacers underneath one of the pole pieces and detector liftoff was achieved by using a flexible spacer material on one side of the defect. Figure 4 shows axial and radial maps from a circular dent in the presence of both magnet pole detector liftoff. The axial signal is almost symmetric, which indicates that the magnet liftoff almost annuls the effect of detector liftoff. However, the radial signal shows a clear asymmetry, indicating that the effect of detector liftoff dominates in the radial signal.

Task 19: Data Analysis

The team has conducting data analysis on multiple levels, including a qualitative contour plot comparison between the overall MFL signals for ‘normal’ and ‘liftoff’ cases; and (a quantitative analysis to determine the percent change in signal as a function of detector and pole piece liftoff. The details of data analysis will be reported in the Phase IV Final Report.

Technical Issues, Problems or Challenges

The project is coordinated with the DOT PHMSA project DTPH56-06-T-000016 “Consolidated Program on In-Line Inspection Technologies” and DTPH56-08-T-000011 “Structural Significance of Mechanical Damage” through PRCI. This coordination ensures that the results from this project are being continually communicated to companies such as Rosen, Battelle, GDF Suez, and BMT Fleet Technology. The team has completed their work determining the effect of detector liftoff on MFL measurements.

Plans for Future Technical Activity

The following work is planned for the next Quarter:

- Submission of the Phase IV Draft Final Report.